



1/41

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OCT 30 2003

TECH CENTER 1600/2900

SEQUENCE LISTING

<110> TOYO BOSEKI KABUSHIKI KAISHA
<120> MODIFIED THERMOSTABLE DNA POLYMERASE
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ccttgattgt tctacaagat tatgggggat gaaag atg atc ctc gac act gac 173

Met Ile Leu Asp Thr Asp

1

5

tac ata acc gag gat gga aag cct gtc ata aga att ttc aag aag gaa 221

Tyr Ile Thr Glu Asp Gly Lys Pro Val Ile Arg Ile Phe Lys Lys Glu

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aac ggc gag ttt aag att gag tac gac cgg act ttt gaa ccc tac ttc 269

Asn Gly Glu Phe Lys Ile Glu Tyr Asp Arg Thr Phe Glu Pro Tyr Phe

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tac gcc ctc ctg aag gac gat tct gcc att gag gaa gtc aag aag ata 317

Tyr Ala Leu Leu Lys Asp Asp Ser Ala Ile Glu Glu Val Lys Lys Ile

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acc gcc gag agg cac ggg acg gtt gta acg gtt aag cgg gtt gaa aag 365

Thr Ala Glu Arg His Gly Thr Val Val Thr Val Lys Arg Val Glu Lys

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65

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gtt cag aag aag ttc ctc ggg aga cca gtt gag gtc tgg aaa ctc tac 413

Val Gln Lys Lys Phe Leu Gly Arg Pro Val Glu Val Trp Lys Leu Tyr

75

80

85

ttt act cat ccg cag gac gtc cca gcg ata agg gac aag ata cga gag 461

Phe Thr His Pro Gln Asp Val Pro Ala Ile Arg Asp Lys Ile Arg Glu

| | | | |
|---|-----|-----|-----|
| 90 | 95 | 100 | |
| cat ggg gca gtt att gac atc tac gag tac gac ata ccc ttc gcc aag | | | 509 |
| His Gly Ala Val Ile Asp Ile Tyr Glu Tyr Asp Ile Pro Phe Ala Lys | | | |
| 105 | 110 | 115 | |
| cgc tac ctc ata gac aag gga tta gtg cca atg gaa ggc gac gag gag | | | 557 |
| Arg Tyr Leu Ile Asp Lys Gly Leu Val Pro Met Glu Gly Asp Glu Glu | | | |
| 120 | 125 | 130 | |
| ctg aaa atg ctc gcc ttc gac att gaa act ctc tac cat gag ggc gag | | | 605 |
| Leu Lys Met Leu Ala Phe Asp Ile Glu Thr Leu Tyr His Glu Gly Glu | | | |
| 135 | 140 | 145 | 150 |
| gag ttc gcc gag ggg cca atc ctt atg ata agc tac gcc gac gag gaa | | | 653 |
| Glu Phe Ala Glu Gly Pro Ile Leu Met Ile Ser Tyr Ala Asp Glu Glu | | | |
| 155 | 160 | 165 | |
| ggg gcc agg gtg ata act tgg aag aac gtg gat ctc ccc tac gtt gac | | | 701 |
| Gly Ala Arg Val Ile Thr Trp Lys Asn Val Asp Leu Pro Tyr Val Asp | | | |
| 170 | 175 | 180 | |
| gtc gtc tcg acg gag agg gag atg ata aag cgc ttc ctc cgt gtt gtg | | | 749 |
| Val Val Ser Thr Glu Arg Glu Met Ile Lys Arg Phe Leu Arg Val Val | | | |
| 185 | 190 | 195 | |

aag gag aaa gac ccg gac gtt ctc ata acc tac aac ggc gac aac ttc 797

Lys Glu Lys Asp Pro Asp Val Leu Ile Thr Tyr Asn Gly Asp Asn Phe

200

205

210

gac ttc gcc tat ctg aaa aag cgc tgt gaa aag ctc gga ata aac ttc 845

Asp Phe Ala Tyr Leu Lys Lys Arg Cys Glu Lys Leu Gly Ile Asn Phe

215

220

225

230

gcc ctc gga agg gat gga agc gag ccg aag att cag agg atg ggc gac 893

Ala Leu Gly Arg Asp Gly Ser Glu Pro Lys Ile Gln Arg Met Gly Asp

235

240

245

agg ttt gcc gtc gaa gtg aag gga cgg ata cac ttc gat ctc tat cct 941

Arg Phe Ala Val Glu Val Lys Gly Arg Ile His Phe Asp Leu Tyr Pro

250

255

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gtg ata aga cgg acg ata aac ctg ccc aca tac acg ctt gag gcc gtt 989

Val Ile Arg Arg Thr Ile Asn Leu Pro Thr Tyr Thr Leu Glu Ala Val

265

270

275

tat gaa gcc gtc ttc ggt cag ccg aag gag aag gtt tac gct gag gaa 1037

Tyr Glu Ala Val Phe Gly Gln Pro Lys Glu Lys Val Tyr Ala Glu Glu

280

285

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ata acc aca gcc tgg gaa acc ggc gag aac ctt gag aga gtc gcc cgc 1085

Ile Thr Thr Ala Trp Glu Thr Gly Glu Asn Leu Glu Arg Val Ala Arg

295 300 305 310

tac tcg atg gaa gat gcg aag gtc aca tac gag ctt ggg aag gag ttc 1133

Tyr Ser Met Glu Asp Ala Lys Val Thr Tyr Glu Leu Gly Lys Glu Phe

315 320 325

ctt ccg atg gag gcc cag ctt tct cgc tta atc ggc cag tcc ctc tgg 1181

Leu Pro Met Glu Ala Gln Leu Ser Arg Leu Ile Gly Gln Ser Leu Trp

330 335 340

gac gtc tcc cgc tcc agc act ggc aac ctc gtt gag tgg ttc ctc ctc 1229

Asp Val Ser Arg Ser Ser Thr Gly Asn Leu Val Glu Trp Phe Leu Leu

345 350 355

agg aag gcc tat gag agg aat gag ctg gcc ccg aac aag ccc gat gaa 1277

Arg Lys Ala Tyr Glu Arg Asn Glu Leu Ala Pro Asn Lys Pro Asp Glu

360 365 370

aag gag ctg gcc aga aga cgg cag agc tat gaa gga ggc tat gta aaa 1325

Lys Glu Leu Ala Arg Arg Arg Gln Ser Tyr Glu Gly Gly Tyr Val Lys

375 380 385 390

gag ccc gag aga ggg ttg tgg gag aac ata gtg tac cta gat ttt aga 1373

Glu Pro Glu Arg Gly Leu Trp Glu Asn Ile Val Tyr Leu Asp Phe Arg

395

400

405

tgc cat cca gcc gat acg aag gtt gtc gtc aag ggg aag ggg att ata 1421

Cys His Pro Ala Asp Thr Lys Val Val Val Lys Gly Lys Gly Ile Ile

410

415

420

aac atc agc gag gtt cag gaa ggt gac tat gtc ctt ggg att gac ggc 1469

Asn Ile Ser Glu Val Gln Glu Gly Asp Tyr Val Leu Gly Ile Asp Gly

425

430

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tgg cag aga gtt aga aaa gta tgg gaa tac gac tac aaa ggg gag ctt 1517

Trp Gln Arg Val Arg Lys Val Trp Glu Tyr Asp Tyr Lys Gly Glu Leu

440

445

450

gta aac ata aac ggg tta aag tgt acg ccc aat cat aag ctt ccc gtt 1565

Val Asn Ile Asn Gly Leu Lys Cys Thr Pro Asn His Lys Leu Pro Val

455

460

465

470

gtt aca aag aac gaa cga caa acg aga ata aga gac agt ctt gct aag 1613

Val Thr Lys Asn Glu Arg Gln Thr Arg Ile Arg Asp Ser Leu Ala Lys

475

480

485

tct ttc ctt act aaa aaa gtt aag ggc aag ata ata acc act ccc ctt 1661

Ser Phe Leu Thr Lys Lys Val Lys Gly Lys Ile Ile Thr Thr Pro Leu

| | | | |
|---|-----|-----|------|
| 490 | 495 | 500 | |
| ttc tat gaa ata ggc aga gcg aca agt gag aat att cca gaa gaa gag | | | 1709 |
| Phe Tyr Glu Ile Gly Arg Ala Thr Ser Glu Asn Ile Pro Glu Glu Glu | | | |
| 505 | 510 | 515 | |
| gtt ctc aag gga gag ctc gct ggc ata cta ttg gct gaa gga acg ctc | | | 1757 |
| Val Leu Lys Gly Glu Leu Ala Gly Ile Leu Leu Ala Glu Gly Thr Leu | | | |
| 520 | 525 | 530 | |
| ttg agg aaa gac gtt gaa tac ttt gat tca tcc cgc aaa aaa cgg agg | | | 1805 |
| Leu Arg Lys Asp Val Glu Tyr Phe Asp Ser Ser Arg Lys Lys Arg Arg | | | |
| 535 | 540 | 545 | 550 |
| att tca cac cag tat cgt gtt gag ata acc att ggg aaa gac gag gag | | | 1853 |
| Ile Ser His Gln Tyr Arg Val Glu Ile Thr Ile Gly Lys Asp Glu Glu | | | |
| 555 | 560 | 565 | |
| gag ttt agg gat cgt atc aca tac att ttt gag cgt ttg ttt ggg att | | | 1901 |
| Glu Phe Arg Asp Arg Ile Thr Tyr Ile Phe Glu Arg Leu Phe Gly Ile | | | |
| 570 | 575 | 580 | |
| act cca agc atc tcg gag aag aaa gga act aac gca gta aca ctc aaa | | | 1949 |
| Thr Pro Ser Ile Ser Glu Lys Lys Gly Thr Asn Ala Val Thr Leu Lys | | | |
| 585 | 590 | 595 | |

gtt gcg aag aag aat gtt tat ctt aaa gtc aag gaa att atg gac aac 1997

Val Ala Lys Lys Asn Val Tyr Leu Lys Val Lys Glu Ile Met Asp Asn

600

605

610

ata gag tcc cta cat gcc ccc tcg gtt ctc agg gga ttc ttc gaa ggc 2045

Ile Glu Ser Leu His Ala Pro Ser Val Leu Arg Gly Phe Phe Glu Gly

615

620

625

630

gac ggt tca gta aac agg gtt agg agg agt att gtt gca acc cag ggt 2093

Asp Gly Ser Val Asn Arg Val Arg Arg Ser Ile Val Ala Thr Gln Gly

635

640

645

aca aag aac gag tgg aag att aaa ctg gtg tca aaa ctg ctc tcc cag 2141

Thr Lys Asn Glu Trp Lys Ile Lys Leu Val Ser Lys Leu Leu Ser Gln

650

655

660

ctt ggt atc cct cat caa acg tac acg tat cag tat cag gaa aat ggg 2189

Leu Gly Ile Pro His Gln Thr Tyr Thr Tyr Gln Tyr Gln Glu Asn Gly

665

670

675

aaa gat cgg agc agg tat ata ctg gag ata act gga aag gac gga ttg 2237

Lys Asp Arg Ser Arg Tyr Ile Leu Glu Ile Thr Gly Lys Asp Gly Leu

680

685

690

ata ctg ttc caa aca ctc att gga ttc atc agt gaa aga aag aac gct 2285

Ile Leu Phe Gln Thr Leu Ile Gly Phe Ile Ser Glu Arg Lys Asn Ala

695

700

705

710

ctg ctt aat aag gca ata tct cag agg gaa atg aac aac ttg gaa aac 2333

Leu Leu Asn Lys Ala Ile Ser Gln Arg Glu Met Asn Asn Leu Glu Asn

715

720

725

aat gga ttt tac agg ctc agt gaa ttc aat gtc agc acg gaa tac tat 2381

Asn Gly Phe Tyr Arg Leu Ser Glu Phe Asn Val Ser Thr Glu Tyr Tyr

730

735

740

gag ggc aag gtc tat gac tta act ctt gaa gga act ccc tac tac ttt 2429

Glu Gly Lys Val Tyr Asp Leu Thr Leu Glu Gly Thr Pro Tyr Tyr Phe

745

750

755

gcc aat ggc ata ttg acc cat aac tcc ctg tac ccc tca atc atc atc 2477

Ala Asn Gly Ile Leu Thr His Asn Ser Leu Tyr Pro Ser Ile Ile Ile

760

765

770

acc cac aac gtc tcg ccg gat acg ctc aac aga gaa gga tgc aag gaa 2525

Thr His Asn Val Ser Pro Asp Thr Leu Asn Arg Glu Gly Cys Lys Glu

775

780

785

790

tat gac gtt gcc cca cag gtc ggc cac cgc ttc tgc aag gac ttc cca 2573

Tyr Asp Val Ala Pro Gln Val Gly His Arg Phe Cys Lys Asp Phe Pro
 795 800 805

gga ttt atc ccg agc ctg ctt gga gac ctc cta gag gag agg cag aag 2621
 Gly Phe Ile Pro Ser Leu Leu Gly Asp Leu Leu Glu Glu Arg Gln Lys
 810 815 820

ata aag aag aag atg aag gcc acg att gac ccg atc gag agg aag ctc 2669
 Ile Lys Lys Lys Met Lys Ala Thr Ile Asp Pro Ile Glu Arg Lys Leu
 825 830 835

ctc gat tac agg cag agg gcc atc aag atc ctg gca aac agc atc cta 2717
 Leu Asp Tyr Arg Gln Arg Ala Ile Lys Ile Leu Ala Asn Ser Ile Leu
 840 845 850

ccc gag gaa tgg ctt cca gtc ctc gag gaa ggg gag gtt cac ttc gtc 2765
 Pro Glu Glu Trp Leu Pro Val Leu Glu Glu Gly Glu Val His Phe Val
 855 860 865 870

agg att gga gag ctc ata gac cgg atg atg gag gaa aat gct ggg aaa 2813
 Arg Ile Gly Glu Leu Ile Asp Arg Met Met Glu Glu Asn Ala Gly Lys
 875 880 885

gta aag aga gag ggc gag acg gaa gtg ctt gag gtc agt ggg ctt gaa 2861
 Val Lys Arg Glu Gly Glu Thr Glu Val Leu Glu Val Ser Gly Leu Glu

| | | | |
|---|-----|-----|------|
| 890 | 895 | 900 | |
| gtc ccg tcc ttt aac agg aga act aac aag gcc gag ctc aag aga gta | | | 2909 |
| Val Pro Ser Phe Asn Arg Arg Thr Asn Lys Ala Glu Leu Lys Arg Val | | | |
| 905 | 910 | 915 | |
| aag gcc ctg att agg cac gat tat tct ggc aag gtc tac acc atc aga | | | 2957 |
| Lys Ala Leu Ile Arg His Asp Tyr Ser Gly Lys Val Tyr Thr Ile Arg | | | |
| 920 | 925 | 930 | |
| ctg aag tcg ggg agg aga ata aag ata acc tct ggc cac agc ctc ttc | | | 3005 |
| Leu Lys Ser Gly Arg Arg Ile Lys Ile Thr Ser Gly His Ser Leu Phe | | | |
| 935 | 940 | 945 | 950 |
| tct gtg aga aac ggg gag ctc gtt gaa gtt acg ggc gat gaa cta aag | | | 3053 |
| Ser Val Arg Asn Gly Glu Leu Val Glu Val Thr Gly Asp Glu Leu Lys | | | |
| 955 | 960 | 965 | |
| cca ggt gac ctc gtt gca gtc ccg cgg aga ttg gag ctt cct gag aga | | | 3101 |
| Pro Gly Asp Leu Val Ala Val Pro Arg Arg Leu Glu Leu Pro Glu Arg | | | |
| 970 | 975 | 980 | |
| aac cac gtg ctg aac ctc gtt gaa ctg ctc ctt gga acg cca gaa gaa | | | 3149 |
| Asn His Val Leu Asn Leu Val Glu Leu Leu Leu Gly Thr Pro Glu Glu | | | |
| 985 | 990 | 995 | |

gaa act ttg gac atc gtc atg acg atc cca gtc aag ggt aag aag aac 3197

Glu Thr Leu Asp Ile Val Met Thr Ile Pro Val Lys Gly Lys Lys Asn

1000

1005

1010

ttc ttt aaa ggg atg ctc agg act ttg cgc tgg att ttc gga gag gaa 3245

Phe Phe Lys Gly Met Leu Arg Thr Leu Arg Trp Ile Phe Gly Glu Glu

1015

1020

1025

1030

aag agg ccc aga acc gcg aga cgc tat ctc agg cac ctt gag gat ctg 3293

Lys Arg Pro Arg Thr Ala Arg Arg Tyr Leu Arg His Leu Glu Asp Leu

1035

1040

1045

ggc tat gtc cgg ctt aag aag atc ggc tac gaa gtc ctc gac tgg gac 3341

Gly Tyr Val Arg Leu Lys Lys Ile Gly Tyr Glu Val Leu Asp Trp Asp

1050

1055

1060

tca ctt aag aac tac aga agg ctc tac gag gcg ctt gtc gag aac gtc 3389

Ser Leu Lys Asn Tyr Arg Arg Leu Tyr Glu Ala Leu Val Glu Asn Val

1065

1070

1075

aga tac aac ggc aac aag agg gag tac ctc gtt gaa ttc aat tcc atc 3437

Arg Tyr Asn Gly Asn Lys Arg Glu Tyr Leu Val Glu Phe Asn Ser Ile

1080

1085

1090

cgg gat gca gtt ggc ata atg ccc cta aaa gag ctg aag gag tgg aag 3485

Arg Asp Ala Val Gly Ile Met Pro Leu Lys Glu Leu Lys Glu Trp Lys

1095

1100

1105

1110

atc ggc acg ctg aac ggc ttc aga atg aga aag ctc att gaa gtg gac 3533

Ile Gly Thr Leu Asn Gly Phe Arg Met Arg Lys Leu Ile Glu Val Asp

1115

1120

1125

gag tcg tta gca aag ctc ctc ggc tac tac gtg agc gag ggc tat gca 3581

Glu Ser Leu Ala Lys Leu Leu Gly Tyr Tyr Val Ser Glu Gly Tyr Ala

1130

1135

1140

aga aag cag agg aat ccc aaa aac ggc tgg agc tac agc gtg aag ctc 3629

Arg Lys Gln Arg Asn Pro Lys Asn Gly Trp Ser Tyr Ser Val Lys Leu

1145

1150

1155

tac aac gaa gac cct gaa gtg ctg gac gat atg gag aga ctc gcc agc 3677

Tyr Asn Glu Asp Pro Glu Val Leu Asp Asp Met Glu Arg Leu Ala Ser

1160

1165

1170

agg ttt ttc ggg aag gtg agg cgg ggc agg aac tac gtt gag ata ccg 3725

Arg Phe Phe Gly Lys Val Arg Arg Gly Arg Asn Tyr Val Glu Ile Pro

1175

1180

1185

1190

aag aag atc ggc tac ctg ctc ttt gag aac atg tgc ggt gtc cta gcg 3773

Lys Lys Ile Gly Tyr Leu Leu Phe Glu Asn Met Cys Gly Val Leu Ala

1195

1200

1205

gag aac aag agg att ccc gag ttc gtc ttc acg tcc ccg aaa ggg gtt 3821

Glu Asn Lys Arg Ile Pro Glu Phe Val Phe Thr Ser Pro Lys Gly Val

1210

1215

1220

cgg ctg gcc ttc ctt gag ggg tac tca tcg gcg atg gcg acg tcc acc 3869

Arg Leu Ala Phe Leu Glu Gly Tyr Ser Ser Ala Met Ala Thr Ser Thr

1225

1230

1235

gaa caa gag act cag gct ctc aac gaa aag cga gct tta gcg aac cag 3917

Glu Gln Glu Thr Gln Ala Leu Asn Glu Lys Arg Ala Leu Ala Asn Gln

1240

1245

1250

ctc gtc ctc ctc ttg aac tcg gtg ggg gtc tct gct gta aaa ctt ggg 3965

Leu Val Leu Leu Leu Asn Ser Val Gly Val Ser Ala Val Lys Leu Gly

1255

1260

1265

1270

cac gac agc ggc gtt tac agg gtc tat ata aac gag gag ctc ccg ttc 4013

His Asp Ser Gly Val Tyr Arg Val Tyr Ile Asn Glu Glu Leu Pro Phe

1275

1280

1285

gta aag ctg gac aag aaa aag aac gcc tac tac tca cac gtg atc ccc 4061

Val Lys Leu Asp Lys Lys Lys Asn Ala Tyr Tyr Ser His Val Ile Pro

| | | | |
|---|------|------|------|
| 1290 | 1295 | 1300 | |
| aag gaa gtc ctg agc gag gtc ttt ggg aag gtt ttc cag aaa aac gtc | | | 4109 |
| Lys Glu Val Leu Ser Glu Val Phe Gly Lys Val Phe Gln Lys Asn Val | | | |
| 1305 | 1310 | 1315 | |
| agt cct cag acc ttc agg aag atg gtc gag gac gga aga ctc gat ccc | | | 4157 |
| Ser Pro Gln Thr Phe Arg Lys Met Val Glu Asp Gly Arg Leu Asp Pro | | | |
| 1320 | 1325 | 1330 | |
| gaa aag gcc cag agg ctc tcc tgg ctc att gag ggg gac gta gtg ctc | | | 4205 |
| Glu Lys Ala Gln Arg Leu Ser Trp Leu Ile Glu Gly Asp Val Val Leu | | | |
| 1335 | 1340 | 1345 | 1350 |
| gac cgc gtt gag tcc gtt gat gtg gaa gac tac gat ggt tat gtc tat | | | 4253 |
| Asp Arg Val Glu Ser Val Asp Val Glu Asp Tyr Asp Gly Tyr Val Tyr | | | |
| 1355 | 1360 | 1365 | |
| gac ctg agc gtc gag gac aac gag aac ttc ctc gtt ggc ttt ggg ttg | | | 4301 |
| Asp Leu Ser Val Glu Asp Asn Glu Asn Phe Leu Val Gly Phe Gly Leu | | | |
| 1370 | 1375 | 1380 | |
| gtc tat gct cac aac agc tac tac ggt tac tac ggc tat gca agg gcg | | | 4349 |
| Val Tyr Ala His Asn Ser Tyr Tyr Gly Tyr Tyr Gly Tyr Ala Arg Ala | | | |
| 1385 | 1390 | 1395 | |

cgc tgg tac tgc aag gag tgt gca gag agc gta acg gcc tgg gga agg 4397

Arg Trp Tyr Cys Lys Glu Cys Ala Glu Ser Val Thr Ala Trp Gly Arg

1400

1405

1410

gag tac ata acg atg acc atc aag gag ata gag gaa aag tac ggc ttt 4445

Glu Tyr Ile Thr Met Thr Ile Lys Glu Ile Glu Glu Lys Tyr Gly Phe

1415

1420

1425

1430

aag gta atc tac agc gac acc gac gga ttt ttt gcc aca ata cct gga 4493

Lys Val Ile Tyr Ser Asp Thr Asp Gly Phe Phe Ala Thr Ile Pro Gly

1435

1440

1445

gcc gat gct gaa acc gtc aaa aag aag gct atg gag ttc ctc aag tat 4541

Ala Asp Ala Glu Thr Val Lys Lys Lys Ala Met Glu Phe Leu Lys Tyr

1450

1455

1460

atc aac gcc aaa ctt ccg ggc gcg ctt gag ctc gag tac gag ggc ttc 4589

Ile Asn Ala Lys Leu Pro Gly Ala Leu Glu Leu Glu Tyr Glu Gly Phe

1465

1470

1475

tac aaa cgc ggc ttc ttc gtc acg aag aag aag tat gcg gtg ata gac 4637

Tyr Lys Arg Gly Phe Phe Val Thr Lys Lys Lys Tyr Ala Val Ile Asp

1480

1485

1490

gag gaa ggc aag ata aca acg cgc gga ctt gag att gtg agg cgt gac 4685

Glu Glu Gly Lys Ile Thr Thr Arg Gly Leu Glu Ile Val Arg Arg Asp

1495

1500

1505

1510

tgg agc gag ata gcg aaa gag acg cag gcg agg gtt ctt gaa gct ttg 4733

Trp Ser Glu Ile Ala Lys Glu Thr Gln Ala Arg Val Leu Glu Ala Leu

1515

1520

1525

cta aag gac ggt gac gtc gag aag gcc gtg agg ata gtc aaa gaa gtt 4781

Leu Lys Asp Gly Asp Val Glu Lys Ala Val Arg Ile Val Lys Glu Val

1530

1535

1540

acc gaa aag ctg agc aag tac gag gtt ccg ccg gag aag ctg gtg atc 4829

Thr Glu Lys Leu Ser Lys Tyr Glu Val Pro Pro Glu Lys Leu Val Ile

1545

1550

1555

cac gag cag ata acg agg gat tta aag gac tac aag gca acc ggt ccc 4877

His Glu Gln Ile Thr Arg Asp Leu Lys Asp Tyr Lys Ala Thr Gly Pro

1560

1565

1570

cac gtt gcc gtt gcc aag agg ttg gcc gcg aga gga gtc aaa ata cgc 4925

His Val Ala Val Ala Lys Arg Leu Ala Ala Arg Gly Val Lys Ile Arg

1575

1580

1585

1590

cct gga acg gtg ata agc tac atc gtg ctc aag ggc tct ggg agg ata 4973

Pro Gly Thr Val Ile Ser Tyr Ile Val Leu Lys Gly Ser Gly Arg Ile

1595

1600

1605

ggc gac agg gcg ata ccg ttc gac gag ttc gac ccg acg aag cac aag 5021

Gly Asp Arg Ala Ile Pro Phe Asp Glu Phe Asp Pro Thr Lys His Lys

1610

1615

1620

tac gac gcc gag tac tac att gag aac cag gtt ctc cca gcc gtt gag 5069

Tyr Asp Ala Glu Tyr Tyr Ile Glu Asn Gln Val Leu Pro Ala Val Glu

1625

1630

1635

aga att ctg aga gcc ttc ggt tac cgc aag gaa gac ctg cgc tac cag 5117

Arg Ile Leu Arg Ala Phe Gly Tyr Arg Lys Glu Asp Leu Arg Tyr Gln

1640

1645

1650

aag acg aga cag gtt ggt ttg agt gct tgg ctg aag ccg aag gga act 5165

Lys Thr Arg Gln Val Gly Leu Ser Ala Trp Leu Lys Pro Lys Gly Thr

1655

1660

1665

1670

tgacctttcc atttgttttc cagcggataa cccitttaact tccctttcaa aaactccctt 5225

tagggaaaga ccatgaagat agaaatccgg cggcgcccgg ttaaatacgc taggatagaa 5285

gtgaagccag acggcaggggt agtcgtcact gccccgaggg ttcaacgttg agaagtt 5342

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<211> 774

<212> PRT

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<400> 2

Met Ile Leu Asp Thr Asp Tyr Ile Thr Glu Asp Gly Lys Pro Val Ile

1 5 10 15

Arg Ile Phe Lys Lys Glu Asn Gly Glu Phe Lys Ile Glu Tyr Asp Arg

20 25 30

Thr Phe Glu Pro Tyr Phe Tyr Ala Leu Leu Lys Asp Asp Ser Ala Ile

35 40 45

Glu Glu Val Lys Lys Ile Thr Ala Glu Arg His Gly Thr Val Val Thr

50 55 60

Val Lys Arg Val Glu Lys Val Gln Lys Lys Phe Leu Gly Arg Pro Val

65 70 75 80

Glu Val Trp Lys Leu Tyr Phe Thr His Pro Gln Asp Val Pro Ala Ile

85 90 95

Arg Asp Lys Ile Arg Glu His Pro Ala Val Ile Asp Ile Tyr Glu Tyr
100 105 110

Asp Ile Pro Phe Ala Lys Arg Tyr Leu Ile Asp Lys Gly Leu Val Pro
115 120 125

Met Glu Gly Asp Glu Glu Leu Lys Met Leu Ala Phe Asp Ile Glu Thr
130 135 140

Leu Tyr His Glu Gly Glu Glu Phe Ala Glu Gly Pro Ile Leu Met Ile
145 150 155 160

Ser Tyr Ala Asp Glu Glu Gly Ala Arg Val Ile Thr Trp Lys Asn Val
165 170 175

Asp Leu Pro Tyr Val Asp Val Val Ser Thr Glu Arg Glu Met Ile Lys
180 185 190

Arg Phe Leu Arg Val Val Lys Glu Lys Asp Pro Asp Val Leu Ile Thr
195 200 205

Tyr Asn Gly Asp Asn Phe Asp Phe Ala Tyr Leu Lys Lys Arg Cys Glu
210 215 220

Lys Leu Gly Ile Asn Phe Ala Leu Gly Arg Asp Gly Ser Glu Pro Lys

225 230 235 240

Ile Gln Arg Met Gly Asp Arg Phe Ala Val Glu Val Lys Gly Arg Ile

245 250 255

His Phe Asp Leu Tyr Pro Val Ile Arg Arg Thr Ile Asn Leu Pro Thr

260 265 270

Tyr Thr Leu Glu Ala Val Tyr Glu Ala Val Phe Gly Gln Pro Lys Glu

275 280 285

Lys Val Tyr Ala Glu Glu Ile Thr Thr Ala Trp Glu Thr Gly Glu Asn

290 295 300

Leu Glu Arg Val Ala Arg Tyr Ser Met Glu Asp Ala Lys Val Thr Tyr

305 310 315 320

Glu Leu Gly Lys Glu Phe Leu Pro Met Glu Ala Gln Leu Ser Arg Leu

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Pro Asn Lys Pro Asp Glu Lys Glu Leu Ala Arg Arg Arg Gln Ser Tyr

370

375

380

Glu Gly Gly Tyr Val Lys Glu Pro Glu Arg Gly Leu Trp Glu Asn Ile

385

390

395

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Lys Lys Met Lys Ala Thr Ile Asp Pro Ile Glu Arg Lys Leu Leu Asp

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525

Glu Glu Lys Tyr Gly Phe Lys Val Ile Tyr Ser Asp Thr Asp Gly Phe

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Phe Ala Thr Ile Pro Gly Ala Asp Ala Glu Thr Val Lys Lys Lys Ala

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550

555

560

Met Glu Phe Leu Lys Tyr Ile Asn Ala Lys Leu Pro Gly Ala Leu Glu

565

570

575

Leu Glu Tyr Glu Gly Phe Tyr Lys Arg Gly Phe Phe Val Thr Lys Lys

580

585

590

Lys Tyr Ala Val Ile Asp Glu Glu Gly Lys Ile Thr Thr Arg Gly Leu

595

600

605

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610

615

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Arg Val Leu Glu Ala Leu Leu Lys Asp Gly Asp Val Glu Lys Ala Val

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| Tyr Lys Ala Thr Gly Pro His Val Ala Val Ala Lys Arg Leu Ala Ala | | | |
| | 675 | 680 | 685 |
| Arg Gly Val Lys Ile Arg Pro Gly Thr Val Ile Ser Tyr Ile Val Leu | | | |
| | 690 | 695 | 700 |
| Lys Gly Ser Gly Arg Ile Gly Asp Arg Ala Ile Pro Phe Asp Glu Phe | | | |
| 705 | 710 | 715 | 720 |
| Asp Pro Thr Lys His Lys Tyr Asp Ala Glu Tyr Tyr Ile Glu Asn Gln | | | |
| | 725 | 730 | 735 |
| Val Leu Pro Ala Val Glu Arg Ile Leu Arg Ala Phe Gly Tyr Arg Lys | | | |
| | 740 | 745 | 750 |
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